

Landsat: Planning the next 20 years of Earth observation and science

Sarah J. Ryker, Matthew C. Larsen, Timothy R. Newman

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ABSTRACT

The Landsat series of Earth-observing satellites began 41 years ago as a partnership between the U.S. Department of the Interior (DOI) and NASA. The U.S. Geological Survey (USGS), as DOI's Earth science agency, provides Landsat's ground systems and data and develops value-added science products and applications. In 2013 the Administration committed to continue the Landsat program for the long term, and directed NASA and USGS to develop a series of spaceborne systems to provide global, continuous Landsat-quality multispectral and thermal infrared measurements for at least 20 years beyond Landsat 9. The Administration also directed the USGS to develop the program's long-term science directions, with special emphasis on making Landsat data more easily used in a wide variety of disciplines and fields of practice.

With Landsats 7 and 8 on orbit, the USGS provides data every eight days for any location on the Earth's land masses. Given eight-day data collection and Landsat's 41-year historical archive, researchers and decision-makers can assess phenomena occurring at weekly to decadal time scales. With this in mind, the USGS has identified a set of Landsat-based science products that will improve applications used by natural resource managers and will contribute to the international and interagency climate monitoring community's initiative to develop consistent climate data records (CDRs) and essential climate variables (ECVs). Key Landsat-derived CDRs include surface reflectance and surface temperature, and ECV products will include measures of fire disturbance, snow covered area, surface water extent, land cover, and above-ground green biomass. These interpretive products will provide an authoritative basis for regional to continental scale identification of historical change, monitoring of current conditions, and predicting future conditions.

The Administration has also assigned USGS the responsibility to analyze Landsat users' needs to inform future operational directions. For example, according to 2012 surveys, two-thirds of Landsat applications studied required eight-day data collection (i.e. multiple satellites on orbit), and applications increasingly rely on the 41-year archive (not only current data). These findings support the need for a near-term replacement for Landsat 7, which has only a few years of fuel left; and the need for Landsat 9 data to be highly compatible with previous Landsat data.

In addition to eight-day repeat data collection and continuity, current themes in users' recommendations range from more frequent data collection for commodity estimates and resource management, to exploring the potential of new imaging instruments, for example by launching future Landsats with prototypes of new sensors on board. USGS continues to work with NASA to examine these options. USGS is also collaborating with commercial and foreign Earth observing institutions to explore alternate means to meet these user needs. For example, the European Commission in 2013 made strides toward a free data policy for the Sentinel-2 program. This and other relationships will augment what Landsat provides to scientists, decision-makers, and the commercial sector.